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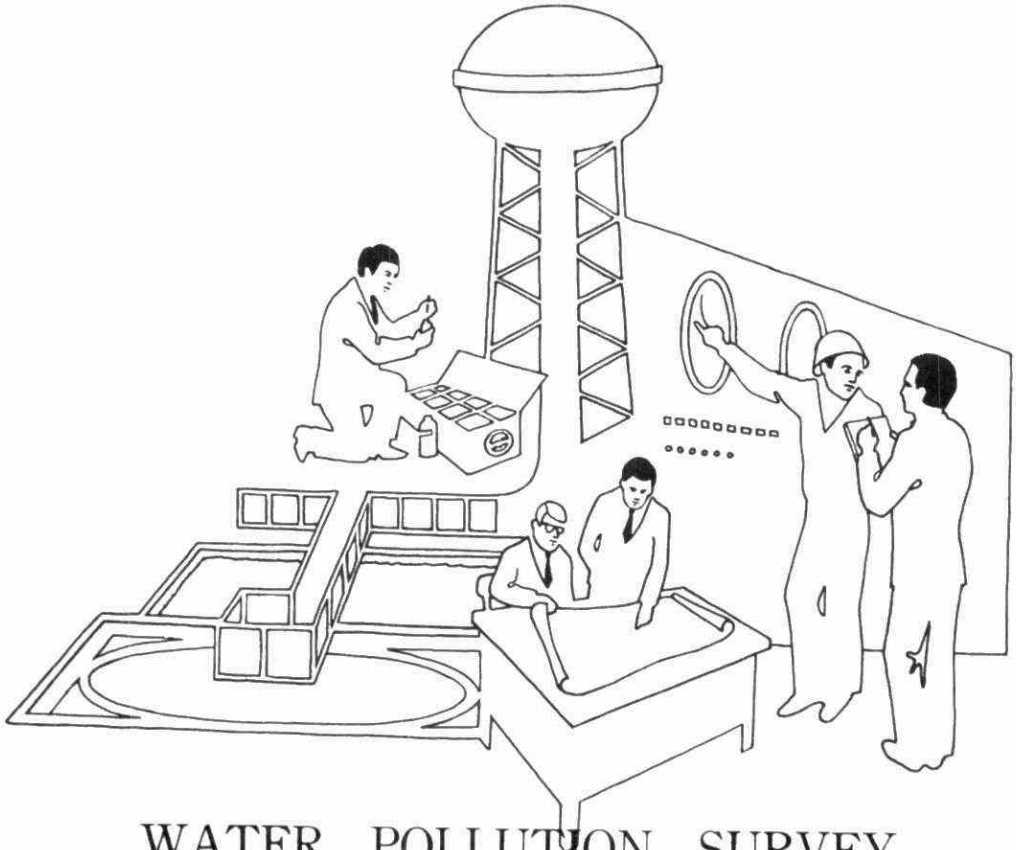

WATER POLLUTION SURVEY

of the

TOWN OF OAKVILLE

SOUTH-EAST AREA

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Report on a water pollution survey of the town of Oakville, south-east area.

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REPORT

ON A

WATER POLLUTION SURVEY

OF THE

TOWN OF OAKVILLE

SOUTH-EAST AREA

DIVISION OF SANITARY ENGINEERING

DISTRICT ENGINEERS BRANCH

July 1971

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R E P O R T

ONTARIO WATER RESOURCES COMMISSION

INTRODUCTION

A water pollution survey of the south-east portion of the Town of Oakville was conducted on March 29, 30 and April 1, 1971. The survey was made following a meeting between representatives of the South-East Oakville Ratepayers Association and the Ontario Water Resources Commission at which time the Ratepayers Association expressed its concern over the problem with septic tank systems in the area and the need for sewering.

The assistance provided by the Halton County Health Unit, Oakville Engineering Department, and the South-East Oakville Ratepayers Association is gratefully acknowledged.

I SUMMARY AND CONCLUSIONS

A water pollution survey was conducted in the south-east area of Oakville to assess the general condition of the area with respect to sewage disposal facilities, storm drainage systems, and the water quality of the receiving streams in the area. It was brought to the attention of the Ontario Water Resources Commission by the South-East Oakville Ratepayers Association that a

pollution problem existed in this area.

The area under study is predominantly residential and serviced with municipal water. Sanitary sewers are provided to only about 10 per cent of the area. The greater portion of the area is served by individual septic tank and tile bed systems. Problems with these septic tank systems have steadily increased in recent years in that many of the tile beds are beginning to malfunction. Surfacing of sewage in the tile bed is occurring and also sewage is breaking out from the tile beds and entering drainage ditches. Seepage from the tile fields may also be reaching the drainage areas.

Bacteriological examination of samples collected from the storm drainage systems in the problem areas has shown extremely high total coliform and fecal coliform counts. This indicates that excretal pollution is occurring and water in the drainage ditches may be considered potentially dangerous as there is a greater probability of the presence of pathogenic (disease-causing) bacteria. Drainage from this area enters Wedgewood Creek and has deteriorated the bacteriological water quality of the creek to a degree that the creek is polluted and unsafe for recreational purposes.

Drainage ditches and storm sewers where fecal pollution is indicated have been pointed out in the report. Where storm sewers contain wastes of human origin, these should be investigated and the contaminating discharge eliminated. In areas where sanitary sewers are provided, residences still on septic tank systems should connect to the sanitary sewer.

Correcting malfunctioning septic tank systems on an individual basis is usually only a temporary measure and does not completely eliminate the problem.

There is a need for complete servicing of the south-east Oakville area with sanitary sewers and the municipality should expedite its sewer installation program to service that area between the Eighth and Ninth Lines, south of the Canadian National Railways right-of-way.

II RECOMMENDATIONS

1. The Corporation of the Town of Oakville should expedite its sewer installation program and provide sanitary sewers in south-east Oakville where water pollution problems exist.
2. Discharges of contaminating wastes to storm sewers and drainage ditches as indicated in the report should be investigated and eliminated.

III GENERAL

The survey area is bounded by Chartwell Road (Eighth Line) on the west, the Canadian National Railways Right-of-Way on the north, Ninth Line on the east, and Lakeshore Road on the south covering approximately 810 acres. This area is completely built-up.

Water for domestic purposes is supplied by the municipality and the use of private wells is probably non-existent. Sanitary sewer services are very limited in the area and it is estimated that only 10 per cent of the area is serviced. The greater portion still utilizes septic tank and tile bed systems for sewage disposal. Where sanitary sewers are provided, domestic wastes are directed to the South-East Oakville Water Pollution Control Plant. Reportedly, it would be 5 years or more before this area is completely sewered.

Many of the existing septic tank systems in the unsewered area are failing to operate satisfactorily and are becoming increasingly more a problem to the residents in the area. Consequently, residents living in the Devon and Ash Roads and Amber Crescent area where, apparently, malfunctioning septic tank syatems are more pronounced, formed the South-East Oakville Ratepayers Association

and examined the problem in their immediate area.

Drainage for the south-east Oakville area under investigation is provided by roadside ditches and storm sewers outfalling to Wedgewood Creek and Morrison Creek. Wedgewood Creek flows in a southerly direction through the eastern half of the area and Morrison Creek does likewise in the western half of the area. Storm sewers and ditches in the area were sampled to determine if domestic sewage was gaining access to the storm drainage systems. Wedgewood and Morrison Creeks were also sampled to determine water quality and the effect of discharges to the creeks on the water quality. A map of the area surveyed is included with the report.

IV WEDGEWOOD CREEK DRAINAGE AREA

While conducting the survey, it was evident that septic tank systems in the area were malfunctioning; leachate from a few tile beds had broken out on the front lawns of residences and was gaining access to the drainage ditches. In some instances near the creek, a septic smell was prevalent in the air. Many of the homes had sump pump discharges to roadside ditches indicating a high water table which would adversely effect the operation of tile bed systems.

A more detailed study of the area resided by the South-East Oakville Ratepayers Association was made as a result of their complaint.

A) Storm Sewers and Drainage Ditches

Weaver Crescent - Bacteriological examination of a sample (W-0.8D) collected from the ditch draining the north side of Weaver Crescent showed a high fecal coliform count, 1,020 coliform/100 ml, indicating domestic sewage was gaining access to the ditch. There was substantial flow in the ditch and the dilution factor may have kept the coliform count low.

Devon Road - Samples collected from a storm sewer (W-0.9D) on the north side of Devon Road, east of Wedgewood Creek indicated that domestic sewage was discharging to the storm sewer. Very high coliform bacteria and fecal coliform counts, 26,800 and 6,000 respectively, were obtained. This storm sewer drains the north side of Devon Road and also Ash Road. The drainage ditch (W-0.9D-4) on the south side of Devon Road, east of the creek also receives domestic wastes of human origin as indicated by the extremely high coliform counts, 75,000 coliform bacteria and 21,000 fecal coliforms.

The drainage ditches west of the creek draining Devon Road and Cairncroft Road North also receive sanitary wastes as indicated by the chemical and bacteriological sample results.

Amber Crescent - The ditch (W-1.0D-2) draining Amber Crescent on the south side, west of the creek contained a high coliform count and BOD level indicating sewage is gaining access to this ditch. Samples collected from the ditch (W-1.0D) on the north side of the road, west of the creek was satisfactory.

Duncan Road - Samples collected from the drainage ditches entering Wedgewood Creek at Duncan Road were found to be satisfactory at the time.

Drummond Road - Bacteriological and chemical samples collected from the ditch (WB-1.1D-6) draining the east side of Drummond Road, just north of Ario Road indicated that domestic wastes were gaining access to this ditch. A high coliform count and 5-Day BOD were obtained.

The ditch (WB-1.1D-2) draining the north side of Amber Crescent in a direction towards Drummond Road was sampled and the chemical results showed a high BOD and suspended solids concentration. Also,

the total coliform and fecal coliform counts were very high indicating that wastes of human origin were entering this ditch.

In general, the ditch on the east side of Drummond Road, north of the creek, is contaminated.

B) Wedgewood Creek Water Quality

A sample (W-1.2) collected from Wedgewood Creek upstream, north of Constance Drive, before entering the residential area indicated that the bacteriological water quality was satisfactory. However, samples collected downstream in the residential area contained coliform bacteria and fecal coliform counts above the OWRC objectives for surface waters. Also, bacteriological samples collected from the west branch of Wedgewood Creek draining the north central portion of the surveyed area contained high coliform counts. The results of the bacteriological samples obtained from Wedgewood Creek are as follows:
(in each case, results are for 100 ml samples)

LOCATION	TOTAL COLIFORM BACTERIA	FECAL COLIFORMS
North of Constance Drive	50	4
West Branch of Cornwall Road	1,300	872
Tributary at Morrison Road	21,500	4,500
West Branch at Drummond Road	5,900	1,400
West Branch at Drummond Road	11,800	3,800
Creek at Duncan Road	9,900	250
Creek at Amber Crescent	1,550	40
Creek at Devon Road	8,600	568
Creek at Weaver Crescent	8,100	1,130
Creek at Alscot Crescent	4,000	204
Creek at Wedgewood Drive	4,400	288

The microbiological criteria for surface waters in Ontario as set out by the OWRC is that the surface water can be considered impaired when the total coliform and/or fecal coliform geometric mean density exceeds 1,000 and 100 respectively.

V MORRISON CREEK DRAINAGE AREA

Here again, while the pollution survey was being carried out, there was evidence of malfunctioning septic tank and tile bed systems. Leachate from tile beds and washwater discharge were gaining access to Morrison

Creek. Also, where sanitary sewers were provided, some residences were still utilizing septic tank systems and ponding of sewage in the tile field area was occurring.

A) Storm Sewers and Drainage Ditches

Lakeshore Road - Two storm sewers (M-0.2W-2 & W-3) draining the north and south sides of Lakeshore Road, west of Morrison Creek were sampled and bacteriological examination indicated that fecal matter was gaining access to these storm sewers. The high suspended solids may have resulted from drainage from construction in the area.

Morrison Road - A bacteriological sample collected from the drainage ditch (M-0.4D) on the east side of Morrison Road, north of Cleaver Drive indicated that fecal matter was gaining access to the ditch. Sanitary sewers are provided on Morrison Road.

Morrison Heights Drive - A sample collected from the storm sewer (M-0.9W-2) draining Morrison Heights Drive contained high total coliform and fecal coliform counts. This reveals that wastes of human origin were entering the storm sewer.

Crestview Street - A drainage ditch (M-0.9D) which is actually a tributary to Morrison Creek and flows in an easterly direction from the Crestview Street area was sampled at the point where it enters Morrison Creek. Bacteriological examination showed a high coliform count indicating domestic wastes were reaching the drainage ditch upstream.

B) Morrison Creek Water Quality

Samples collected from Morrison Creek at Lynbrook Road and from the west branch of Morrison Creek at Chartwell Road indicated that the bacteriological water quality of the creek was satisfactory. Also, the 5-Day Biochemical Oxygen Demand was low at these locations. However, downstream samples show the 5-Day BOD to increase indicating organic wastes entering the creek were deteriorating the water quality.

A bacteriological sample collected from the creek at Morrison Road contained high total coliform and fecal coliform counts. Other bacteriological samples collected from the creek may indicate that the creek is intermittently contaminated and the dilution factor provided by the flow in the creek keeps the bacteriological count lower. The bacteriological

sample results from Morrison Creek are as follows:

LOCATION	TOTAL COLIFORM BACTERIA	FECAL COLIFORMS
Creek at Lynbrook Road	416	18
Tributary at Chartwell Road	212	40
Creek at Balmoral Plaza	1,328	44
Creek at Burgundy Drive	76	8
Creek at Morrison Road	11,100	2,200
Creek at Lakeshore Road	960	272

VI SOUTH-EAST OAKVILLE RATEPAYERS ASSOCIATION SURVEY

A survey was conducted by the Ratepayers Association in which a questionnaire was given to eighty homeowners in the Association's area concerning the operation of their septic tank systems. The results of the survey revealed that 40 per cent indicated that their septic tank - tile bed was inadequate and 56 per cent indicated the tile bed was performing poorly. The majority of the homeowners, 81 per cent, replied that they would like to have sanitary sewers installed in the area in one year. They are concerned for the health of their children who would be exposed to the sewage while playing in the drainage ditches and Wedgewood Creek.

VII HALTON COUNTY HEALTH UNIT REPORT

In October of 1970, the Halton County Health

Unit sampled Wedgewood Creek in the area represented by the South-East Oakville Ratepayers Association and the results are as follows:

LOCATION	TOTAL COLIFORMS	FECAL COLIFORMS
Duncan Road	80,000+	8,000+
Drummond Road	80,000	4,600
Devon Road (north side)	12,000	600
Devon Road (south side)	37,000	8,000+
Weaver Crescent	47,000	8,000+

The results indicate that Wedgewood Creek was bacteriologically contaminated at the time and would have been considered unsafe for recreational purposes.

In a letter to the Ratepayers Association concerning septic tank systems, it was the opinion of the health unit that septic tank systems in a subdivision are not satisfactory and should only be allowed on very large lots in areas where municipal services are not likely. Also, it has been the health unit's experience that a great many of the septic tank - tile beds do not function properly after 10 - 12 years.

VIII COMMENTS

The results of the survey show that a water pollution problem exists in the south-east area of Oakville

due to malfunctioning septic tank systems. In some areas, ponding of sewage on front lawns where tile beds are located was occurring. Also, leachate from the tile fields was breaking out and reaching roadside ditches. At some locations, septic odours were prevalent at the creek where the ditches drain to the creek.

These problems are more pronounced in the area represented by the South-East Oakville Ratepayers Association, the Devon-Ash-Amber area between Wedgewood and Drummond Roads. Problems with septic tank - tile beds are becoming increasingly more prevalent as years progress.

Extensive sampling of drainage ditches in this area has shown extremely high total coliform and fecal coliform counts indicating excretal pollution. This also indicates that the water in the ditches is potentially dangerous. The effect of the drainage to Wedgewood Creek is that it is deteriorating the bacteriological quality of the water as the creek flows through the area. The municipality should provide sanitary sewers in this area as soon as possible to eliminate the pollution problem.

In the Morrison Creek drainage area, there was also evidence of malfunctioning septic tank systems. Ponding of sewage was occurring in areas where sanitary

sewers are available and homes should be connected to the sanitary sewer. Bacteriological examination of samples collected from a few storm sewers and drainage ditches indicated that fecal matter was gaining access to these drainage systems. Discharges of contaminating wastes to the storm sewer system should be eliminated. Certain sections of Morrison Creek are polluted due to the drainage discharges.

Septic tank systems in the South-East Oakville area are malfunctioning and drainage from these systems is gaining access to Wedgewood and Morrison Creeks and consequently, deteriorating the bacteriological quality of the water. Wedgewood Creek would be considered polluted and unsafe for recreational purposes.

Prepared by: G.K. Boretski

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District Engineers Branch
Division of Sanitary Engineering

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TABLE I

WEDGEWOOD CREEK - STREAM SAMPLING

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	ANIONIC DETERGENTS AS ABS	TOTAL KJELDAHL AS N	TOTAL PHOSPHORUS AS P	COLIFORM BACTERIA	FECAL COLIFORMS
W-0.4	WEDGEWOOD CREEK AT WEDGEWOOD DRIVE	MARCH 30/71	1.4	630	10	620	0.1	0.6	0.13	4,400	288
W-0.7	WEDGEWOOD CREEK AT ALSCOT CRESCENT	MARCH 30/71	1.2	640	15	625	0.1	0.44	0.10	4,000	204
W-0.8	WEDGEWOOD CREEK AT WEAVER CRESCENT	APRIL 1/71	2.5	480	5	475	**	0.40	0.12	8,100	1,130
W-0.9	WEDGEWOOD CREEK AT DEVON ROAD	MARCH 30/71	2.0	630	15	615	0.1	0.55	0.11	8,600	568
W-1.0	WEDGEWOOD CREEK AT AMBER CRESCENT	MARCH 30/71	1.2	630	15	615	0.4	0.60	.09	1,550	40
W-1.1	WEDGEWOOD CREEK AT DUNCAN ROAD	APRIL 1/71	3.0	560	75	550	0.1	0.85	0.2	9,900	250
W-1.2	WEDGEWOOD CREEK AT CONSTANCE DRIVE	MARCH 30/71	1.4	610	10	600	**	0.40	..08	50	<4
WB-1.1	WEDGEWOOD CREEK, WEST BRANCH AT DRUMMOND ROAD	MARCH 30/71	1.4	715	5	710	0.1	0.66	.21	5,900	1,400
		APRIL 1/71	1.8	700	20	680	**	**	**	11,800	3,800
WB-1.5	WEDGEWOOD CREEK, WEST BRANCH AT CORNWALL ROAD	MARCH 30/71	1.2	935	10	925	0.1	.76	.076	1,300	872
WA-1.3	WEDGEWOOD CREEK, WEST BRANCH AT MORRISON ROAD	MARCH 30/71	2.5	590	10	580	0.2	0.60	.30	21,500	4,500

TABLE II

WEDGEWOOD CREEK - OUTFALL SAMPLING

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	ANIONIC DETERGENTS AS ABS	TOTAL KJELDAHL AS N	TOTAL PHOSPHORUS AS P	COLIFORM BACTERIA	FECAL COLIFORMS
W-0.7 W	STORM SEWER WEST OF WEDGEWOOD DRIVE, NORTH OF ALSCOT CRESCENT	APRIL 1/71	2.5	480	5	475	**	0.40	0.12	56	<4
W-0.8 D	DRAINAGE DITCH - NORTH SIDE OF WEAVER CRESCENT	MARCH 30/71	1.4	670	5	665	0.1	.55	.16	1,100	1,020
W-0.8 D-2	MUTUAL SUMP DITCH BETWEEN RESIDENCES ON WEAVER CRESCENT	MARCH 30/71	0.6	780	5	775	0.0	0.20	.024	500	420
W-0.9 D	DRAINAGE DITCH AT DEVON ROAD NORTH-EAST SIDE OF ROAD	APRIL 1/71	5.0	1,220	10	1,210	**	2.2	0.63	26,800	6,000
W-0.9 D-2	DRAINAGE DITCH AT DEVON ROAD NORTH-WEST SIDE OF ROAD	APRIL 1/71	3.5	1,080	35	1,045	**	0.55	0.36	28,700	9,900
W-0.9 D-3	DRAINAGE DITCH AT DEVON ROAD SOUTH-WEST SIDE OF ROAD	APRIL 1/71	1.6	1,320	15	1,305	**	0.80	.090	96	<4
W-0.9 D-4	DRAINAGE DITCH AT DEVON ROAD SOUTH-EAST SIDE OF ROAD	APRIL 1/71	1.8	820	5	815	**	0.55	0.36	75,000	21,800
W-1.0 D	DRAINAGE DITCH AT AMBER CRESCENT NORTH-WEST SIDE OF CRESCENT	APRIL 1/71	1.0	610	5	605	0.1	**	**	12	12
W-1.0 D-2	DRAINAGE DITCH AT AMBER CRESCENT SOUTH-WEST SIDE OF CRESCENT	APRIL 1/71	19	780	15	765	1.8	4.0	5.0	11,000	512

TABLE II (CONT'D)

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	ANIONIC DETERGENTS AS ABS	TOTAL KJELDAHL AS N	TOTAL PHOSPHORUS AS P	COLIFORM BACTERIA	FECAL COLIFORMS
W-1.1 D	DRAINAGE DITCH AT DUNCAN ROAD NORTH-EAST SIDE OF ROAD	APRIL 1/71	2.5	1,230	195	1,035	0.1	1.1	0.25	50,000	<10
W-1.1 D-2	DRAINAGE DITCH AT DUNCAN ROAD NORTH-WEST SIDE OF ROAD	APRIL 1/71	1.2	745	5	740	**	0.50	.070	440	8
W-1.1 D-3	DRAINAGE DITCH AT DUNCAN ROAD SOUTH-WEST SIDE OF ROAD	APRIL 1/71	1.2	920	10	910	**	0.45	.090	156	<4
W-1.1 D-4	DRAINAGE DITCH AT DUNCAN ROAD SOUTH-EAST SIDE OF ROAD	APRIL 1/71	1.0	970	5	965	**	0.60	0.39	1,600	4
W-1.1 W	STORM SEWER FROM ACTON CRESCENT	APRIL 1/71	2.5	540	5	535	**	0.95	.031	24	<4
W-1.2 D	DRAINAGE DITCH NORTH OF AVON CRESCENT	MARCH 30/71	1.2	490	10	480	0.1	0.52	.056	64	<4
WB-1.1 D	STORM SEWER, EAST OF DRUMMOND ROAD, NORTH OF CREEK	APRIL 1/71	1.6	780	5	775	**	0.55	0.19	3,400	232
WB-1.1 D-2	DRAINAGE DITCH NORTH SIDE OF AMBER CRESCENT, EAST OF DRUMMOND ROAD	MARCH 30/71	7.0	995	125	870	0.1	2.4	.89	30,300	1,200
WB-1.1 D-3	DRAINAGE DITCH, EAST SIDE OF DRUMMOND ROAD, NORTH OF AMBER CRESCENT	MARCH 30/71	2.5	760	10	750	0.1	.64	1.0	12,000	40
WB-1.1 D-4	DRAINAGE DITCH, NORTH SIDE OF DUNCAN ROAD, EAST OF DRUMMOND ROAD	MARCH 30/71	0.8	970	5	965	0.1	.93	0.77	90	<4

TABLE II (CONT'D)

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	ANIONIC DETERGENTS AS ABS	TOTAL KJELDAHL AS N	TOTAL PHOSPHORUS AS P	COLIFORM BACTERIA	FECAL COLIFORMS
WB-1.1 D-5	DRAINAGE DITCH, NORTH SIDE OF ARIO ROAD, EAST OF DRUMMOND ROAD	MARCH 30/71	2.5	665	5	660	0.0	.36	.064	40	<4
WB-1.1 D-6	DRAINAGE DITCH, EAST SIDE OF DRUMMOND ROAD, NORTH OF ARIO ROAD	MARCH 30/71	5.0	845	10	835	0.1	1.2	1.6	3,900	148
WB-1.1 D-7	DRAINAGE DITCH, WEST SIDE OF DRUMMOND ROAD, NORTH OF CREEK	APRIL 1/71	2.0	2,200	5	2,195	**	0.80	.060	12	<4
WB-1.1 D-8	DRAINAGE DITCH, WEST SIDE OF DRUMMOND ROAD, SOUTH OF CREEK	APRIL 1/71	1.4	760	10	750	**	0.55	.030	88	<4
WB-1.3 D	DRAINAGE DITCH, NORTH SIDE OF AVON CRESCENT, EAST OF CREEK	APRIL 1/71	2.5	520	5	515	**	0.65	1.0	40	<4
WB-1.3 D-2	DRAINAGE DITCH, SOUTH SIDE OF AVON CRESCENT, EAST OF CREEK	APRIL 1/71	2.5	560	25	535	0.1	0.70	0.11	12	<4

TABLE III

MORRISON CREEK - STREAM SAMPLING

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	ANIONIC DETERGENTS AS ABS	TOTAL KJELDAHL AS N	TOTAL PHOSPHORUS AS P	COLIFORM BACTERIA	FECAL COLIFORMS
M-0.2	MORRISON CREEK AT LAKESHORE ROAD	MARCH 29/71	3.5	520	15	505	0.1	0	**	960	272
M-0.4	MORRISON CREEK AT MORRISON ROAD	MARCH 29/71	5.0	460	10	450	**	2	0	11,100	2,200
M-0.9	MORRISON CREEK AT BURGUNDY DRIVE	MARCH 29/71	2.0	480	5	475	0.0	0	**	76	8
M-1.0	MORRISON CREEK AT BALMORAL PLACE	MARCH 29/71	3.0	490	5	485	0.1	3	**	1,325	44
M-1.2	MORRISON CREEK AT LYNBROOK ROAD	MARCH 29/71	1.2	850	5	845	0.1	0	**	416	18
MA-1.2	MORRISON CREEK, WEST BRANCH CHARTWELL ROAD	MARCH 29/71	1.0	420	10	410	0.0	3	**	212	40

TABLE IV

MORRISON CREEK - OUTFALL SAMPLING

SAMPLING POINT NUMBER	DESCRIPTION	DATE	5-DAY BOD (PPM)	SOLIDS (PPM) TOTAL	SUSP.	DISS.	ANIONIC DETERGENTS AS ABS	TOTAL KJELDAHL AS N	TOTAL PHOSPHORUS AS P	COLIFORM BACTERIA	FECAL COLIFORMS
M-0.2 W	STORM SEWER - LAKESHORE ROAD, SOUTH-EAST SIDE	MARCH 29/71		NO FLOW NOTED							
M-0.2 W-2	STORM SEWER - LAKESHORE ROAD, SOUTH-WEST SIDE	MARCH 29/71	4.5	820	25	795	0.5	6	**	80,000	7,000
M-0.2 W-3	STORM SEWER - LAKESHORE ROAD, NORTH-WEST SIDE	MARCH 29/71	3.0	520	35	485	0.2	0	**	10,200	820
M-0.2 W-4	STORM SEWER - LAKESHORE ROAD, NORTH-EAST SIDE	MARCH 29/71		NO FLOW NOTED							
M-0.2 W-5	STORM SEWER - EAST SIDE OF CREEK, NORTH OF LAKESHORE ROAD	MARCH 29/71	0.6	640	5	635	0.0	3	**	124	<4
M-0.4 D	DRAINAGE DITCH EAST SIDE OF MORRISON ROAD, NORTH OF CLEAVER DRIVE	MARCH 29/71	3.0	450	5	445	0.1	0	0	7,000	1,800
M-0.4 D-2	DRAINAGE DITCH, NORTH SIDE OF CLEAVER DRIVE EAST OF MORRISON ROAD	MARCH 29/71	1.6	510	10	500	**	2	0	26	<4
M-0.9 W	15" Ø STORM SEWER - BURGUNDY DRIVE	MARCH 29/71	1.0	580	5	575	0.1	0	**	260	<4
M-0.9 W-2	18" Ø STORM SEWER - MORRISON HEIGHTS DRIVE	MARCH 29/71	0.6	470	5	405	0.1	0	**	5,100	612
M-0.9 D	TRIBUTARY OF MORRISON CREEK DRAINAGE DITCH AT WALK-BRIDGE	MARCH 29/71	2.0	560	25	535	0.1	3	**	8,300	196
M-1.0 W	21" Ø STORM SEWER - ASCOT DRIVE	MARCH 29/71	0.4	730	5	725	**	0	0	4	<4

APPENDIX

WATER QUALITY AND EFFLUENT OBJECTIVES

The OWRC objectives for surface waters is described in a booklet entitled "Guidelines and Criteria for Water Quality Management in Ontario". A copy of the booklet is enclosed in the pocket on the back cover of this report. This publication contains the guidelines and introduces water quality criteria for various uses including public, agricultural and industrial water supply, recreation, aesthetic enjoyment and the propagation of fish and wildlife. The guidelines should be followed to determine the acceptability of a watercourse for various uses.

A few pertinent maximum limits of contaminants in sewage treatment plant and industrial effluents are listed below. Adequate protection for surface waters except in certain specific instances influenced by local conditions, should be provided if the following concentrations and pH range are not exceeded.

5-day BOD - not greater than 15 ppm
Suspended Solids - not greater than 15 ppm
Phenols - not greater than 20 ppb
pH - 5.5 to 10.6
Iron - not greater than 17 ppm
Ether Solubles (Oil) -not greater than 15 ppm

GLOSSARY OF TERMS

Bacteriological Examinations - The Membrane Filter Technique is used to obtain a direct count of coliform organisms. These organisms are the normal inhabitants of the intestines of man and other warm-blooded animals. They are always present in large numbers in untreated sewage and are, in general, relatively few in number in other stream pollutants.

Biochemical Oxygen Demand (BOD) - The biochemical oxygen demand test indicates the amount of oxygen required for stabilization of the decomposable organic matter found in sewage, sewage effluent, polluted waters, or industrial wastes, by aerobic biochemical action.

Solids - The analyses for solids include tests for total, suspended and dissolved solids. The total solids is a measure of the solids in solution and in suspension. Suspended solids indicate the measure of undissolved solids of organic or inorganic nature whereas the dissolved solids are a measure of those solids in solution.

Oils and Ether Soluble Materials - These include oils and all other soluble materials such as tarry substances and greases. The presence of these pollutants renders water difficult and sometimes impractical to treat either for industrial or domestic use. Oils make streams unsightly and water unfit for bathing.

Phenolic Compounds - The presence of phenol or phenolic equivalents is generally associated with discharges containing petroleum products, or with wastes from some industries. It is generally conceded that adequate protection of surface waters will be provided if the concentration of phenols in waste discharges does not exceed 20 parts per billion (ppb). Phenolic type waste can cause objectionable conditions in water supplies and might taint the flesh of fish.

Alkyl Benzene Sulfonate (ABS) - The alkyl benzene sulfonate portion of the anionic detergents is reported in ppm. The test is generally employed to indicate the presence of domestic wastewater. The popular use of synthetic detergent for general cleaning purposes have resulted in the incidence of residual ABS in streams. As an objective, the ABS concentration should not exceed 0.5 ppm in water used for domestic purposes.

Iron - Water for domestic use should contain less than 0.3 parts per million of iron in order to avoid objectionable tastes, staining and sediment formation. Iron concentrations of not greater than 17 parts per million in waste discharges should permit adequate protection of surface waters.

Nitrogen

Ammonia Nitrogen or sometimes called free ammonia is the insoluble product in the decomposition of nitrogenous

organic matter. It is also formed when nitrates and nitrites are reduced to ammonia either biologically or chemically. Some small amounts of ammonia, too, may be swept out of the atmosphere by rain water.

The following values may be of general significance in appraising free ammonia content: Low 0.015 to 0.03 ppm; moderate 0.03 to 0.10 ppm; high 0.10 or greater.

Total Kjeldahl is a measure of the total nitrogenous matter present except that measured as nitrite and nitrate nitrogens. The Total Kjeldahl less the Ammonia Nitrogen measures the organic nitrogen present. Ammonia and organic nitrogen determinations are important in determining the availability of nitrogen for biological utilization. The normal range for Total Kjeldahl would be 0.1 to 0.5 ppm.

Nitrite Nitrogen

Nitrite is usually an intermediate oxidation of ammonia. The significance of nitrites, therefore, varies with their amount, sources, and relation to other constituents of the sample, notably the relative magnitude of ammonia and nitrite present. Since nitrite is rapidly and easily converted to nitrate, its presence in concentrations greater than a few thousandths of a part per million is

generally indicative of active biological processes in the water.

Nitrate Nitrogen

Nitrate is the end product of aerobic decomposition of nitrogenous matter, and its presence carries this significance. Nitrate concentration is of particular interest in relation to the other forms of nitrogen that may be present in the sample. Nitrates occur in the crust of the earth in many places and are a source of its fertility.

Phosphorus

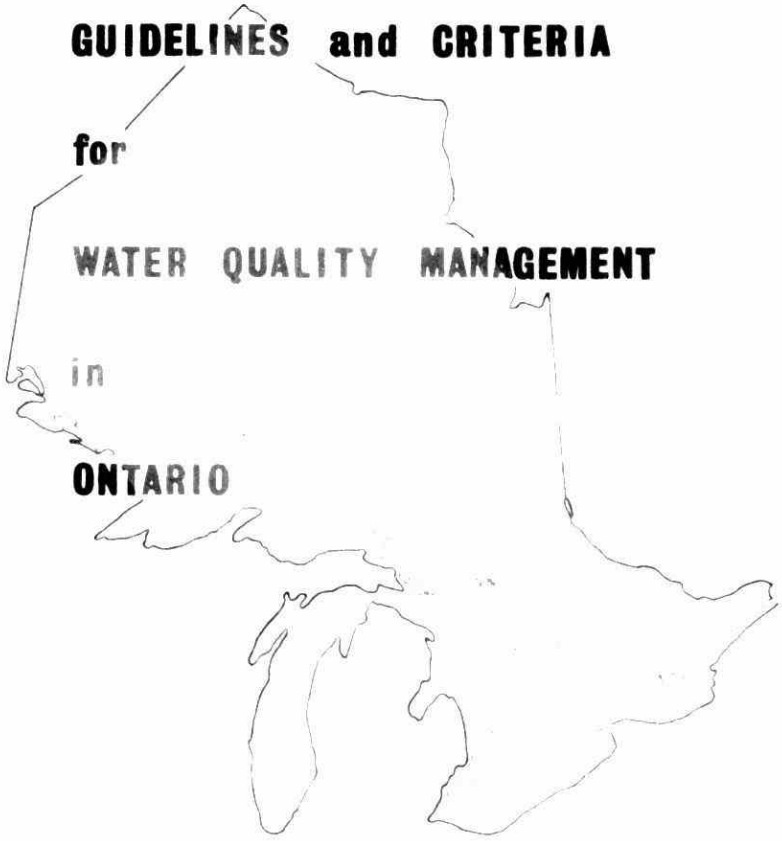
Total Phosphorus - Total Phosphorus is a measure of both the organic and inorganic forms of phosphorus present.

Soluble Phosphorus - Soluble Phosphorus is a measure of the orthophosphate only and when subtracted from the total phosphorus gives an indication of the concentration of organic phosphorus present. That is, the soluble phosphorus is a measure of the inorganic phosphorus present, except the phosphorus in the form of polyphosphate, which however, in surface waters is usually insignificant. Inorganic phosphorus in concentration in excess of 0.01 ppm may cause nuisance conditions.

Ontario
Water Resources Commission

June 1970

GUIDELINES and CRITERIA for WATER QUALITY MANAGEMENT in ONTARIO



GUIDELINES AND CRITERIA

FOR

WATER QUALITY MANAGEMENT IN ONTARIO

BY THE

ONTARIO WATER RESOURCES COMMISSION

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INTRODUCTION

In 1967, the Ontario Water Resources Commission announced its Policy Guidelines for Water Quality Control in the Province of Ontario. This publication contains a re-statement of the guidelines and introduces water quality criteria for various uses including public, agricultural and industrial water supply, recreation, aesthetic enjoyment and the propagation of fish and wildlife. The use of water for assimilation and dilution of treated wastes must take into consideration these many desirable uses. Application of the criteria to water uses within the drainage basins of the province, or parts thereof, will lead to the development of water quality standards for the control of water pollution.

GUIDELINES FOR THE CONTROL OF WATER QUALITY

1 The water resources of Ontario must meet many needs, some of which are in conflict. The standards established, therefore, must be based on the best interests of the people of Ontario. These interests require the preservation, and restoration where necessary, of the quality of our water for the greatest number of uses. The use of water for the assimilation and dilution of treated waste effluents must take into consideration the variety of uses, including public, agricultural and industrial supply, recreation, aesthetic enjoyment and the propagation of fish and wildlife.

2 For each use of water there are certain water quality characteristics, identified as criteria, which should be met to ensure that the water is suitable for that use.

3 Water quality standards will be established by the Ontario Water Resources Commission for waters of drainage basins or parts thereof with important water uses, following consultation with agencies or persons having an interest or responsibility in the present or future use of the water in the basin for which the standards are to be established.

4 Water of a higher quality than that required by the standards will be maintained at that higher quality unless in the public interest an alteration of the quality is consistent with the protection of all uses which are in accordance with the water quality standards established.

There should be a constant effort to improve the quality of water, for it is recognized that the improvement of the quality of water makes it available for more uses.

5 Requirements for effluents and land drainage based on the applicable water quality standards, or criteria where such standards do not exist, will be established by the Commission in order to maintain acceptable water quality. More stringent methods of control and/or treatment of waste inputs and land drainage may become necessary as the use of water changes or increases, or as standards are re-defined.

6 In establishing effluent requirements from water quality standards a reserve capacity of the receiving water should be set aside to provide an adequate margin of protection in recognition of the limitations of water management theory and practice.

7 All wastes prior to discharge to any receiving watercourse must receive the best practicable treatment or control. Such treatment must be adequate to protect and wherever possible upgrade water quality in the face of population and industrial growth, urbanization and technological change.

8 Criteria and standards of water quality and effluent requirements will be defined quantitatively only where sound numerical information is available; otherwise, they will be described in appropriate detail. They will be re-defined from time to time in the light of new evidence.

WATER QUALITY CRITERIA

The following criteria for water quality are a set of numerical and descriptive characteristics, carefully defined, and applicable to each major water use category such as agriculture; fish, other aquatic life and wildlife; industrial water supply; public water supply; recreation and aesthetics. The criteria are described for use in establishing Water Quality Standards for drainage basins which in turn will be used to determine Effluent Requirements for discharges of wastes and land drainage.

The responsibility for demonstrating that a waste effluent is harmless to water uses in the concentrations to be found in the receiving waters, rests with those producing the discharge. Zones of passage and/or mixing adjacent to outfalls at the limit of which water quality may be critical, will be prescribed by the Commission.

Reference is frequently made in the Criteria to the Report of the Committee on Water Quality, Federal Water Pollution Control Administration, U.S. Department of the Interior (1968). Acknowledgement of the report is gratefully given in recognition of its basic reference value.

ZONES OF PASSAGE AND MIXING

Mixing zones in the vicinity of outfalls should be restricted as much as possible in extent and should provide for the safe passage of both fish and free-floating and drift organisms. Every precaution should be taken to ensure that at least two-thirds of the total cross-sectional area of a river or stream is characterized by a quality which is entirely favourable to the aquatic community at all times. In most cases this would preclude the use of a diffuser outfall which would distribute effluent uniformly across the river or stream. The water quality standard which defines the acceptable concentration of a substance contained in a waste discharge will apply at the periphery of the mixing zone or other specified sampling location.

Within mixing zones, it should be recognized that toxic wastes which will not evoke an avoidance response on the part of fish or other organisms should not be permitted. Where toxic materials are being discharged it should be assumed that the various components in the waste, regardless of the form in which they are present, may eventually be altered to the most toxic form in the aquatic environment. Adequate treatment of all wastes should be provided and mixing zones should not be considered as a substitute for proper treatment.

STATISTICAL PROBLEMS IN SETTING LIMITS

The systematic surveillance of water and waste sources requires the collection of data to clearly represent the problems being studied. The problems are many and varied. In one case the average condition over a period of time may be required and the question arises over what period shall the average or median be taken; in another, the limit may be a figure that should not be exceeded at any time. If a standard for a certain constituent is "none", the question arises "how small an amount does this mean?" The answers vary with the type of standard and the circumstances governing the fluctuation of the indicator. In ground water problems, only the average over a considerable period of time is significant. Where required in the setting of standards and effluent requirements, definitions of limits will include the applicable sampling conditions, quantitative values and rates of discharge.

1 WATER QUALITY CRITERIA FOR AGRICULTURAL USES (AGR)

Agricultural production requires water of suitable quality for a variety of uses. Criteria for the major uses are given under three headings: Dairy Sanitation, Livestock Watering, and Irrigation.

Requirements for domestic and other farmstead uses and the common requirements for dairy sanitation are given elsewhere in the criteria for Private Water Supplies and Public Water Supplies.

AGR-1 Dairy Sanitation

Modern methods for bulk handling of milk on farms require large volumes of good quality water to ensure a premium product. The quality of water needed for good dairy sanitation requires criteria for certain parameters that are additional to, or more stringent than, those required for private water supplies. These are summarized under the headings "Permissible Criteria" and "Desirable Criteria". They should be used in conjunction with the criteria for public and private water supplies.

Treatment may prove satisfactory in meeting the criteria for certain of the inorganic chemicals such as iron and total hardness.

Waters that meet the desirable microbiological criteria can be used without disinfection; those meeting the permissible criteria require disinfection (chlorination), or chlorination and filtration, before use to reduce bacteria to levels where they will not cause deterioration of the quality of milk. Waters used for dairy sanitation should be sampled and tested at least monthly, in some cases daily, to ensure that they meet the microbiological criteria.

TABLE AGR-1

Water Quality Criteria for Agricultural Uses
Dairy Sanitation

Constituent or Characteristic	Permissible Criteria	Desirable Criteria
Inorganic Chemicals:		
Copper	0.1 mg/l	
Iron	0.1 mg/l	
pH (range)	6.8 to 8.5	
Potassium	20 mg/l	
Total hardness as $CaCO_3$	150 mg/l	100 mg/l
Microbiological:		
Proteolytic and/or Lipolytic bacteria (20°C) (individual results)	500/100 ml	0/100 ml
Yeast		Absent
Mould		Absent
Physical:		Clear Colourless Good taste

AGR-2 Livestock Watering

The health and productivity of livestock are affected by the quantities of various substances ingested as feed and as water. Accordingly, the amounts of certain substances that can be present without harm in water consumed by livestock will depend in part on the amounts of the same substances that are present in the feed in addition to a number of other factors which include: the daily water requirements and the species, age, and physiological condition of the animals, and the nature and quantities of other constituents of the feed and water.

Animals may be able to tolerate a fairly high level of total dissolved solids or bacteria if they are accustomed to such levels, but may be unable to tolerate a sudden change from waters with low dissolved solids or bacteria to waters with high dissolved solids or bacteria.

In addition to direct effects on the animals, certain substances may contaminate animal products to the point where they will not be acceptable for human consumption.

The variability of the factors that influence the acceptability of water for livestock-watering purposes must be considered when using the water quality criteria. Although the criteria provide a general guide to the quality of water that will be acceptable for most livestock, there may be cases where water of different quality than that indicated by the criteria will be required or acceptable because of the nature, age, or condition of species being raised or because of special rearing conditions or feed components. In such cases, or where the quality of an individual supply is in doubt, the quality should be assessed in relation to the specific use.

Water meeting the permissible criteria will be satisfactory for most livestock under normal rearing conditions. Water meeting the desirable criteria should provide a palatable and safe source for all normal livestock-watering purposes.

TABLE AGR-2
Water Quality Criteria for Agricultural Uses
Livestock

Constituent or Characteristic	Permissible Criteria	Desirable Criteria
General Quality		ideally should meet the desirable criteria for private water supplies.
Inorganic Chemicals:		
Total Dissolved Solids	2500 mg/l	< 500 mg/l
Arsenic	0.05 mg/l	Absent
Cadmium	0.01 mg/l	Absent
Chromium (hexavalent)	0.05 mg/l	Absent
Fluoride	2.4 mg/l	1.2 mg/l
Lead	0.05 mg/l	Absent
Nitrate plus Nitrite (as N)	20 mg/l	< 10 mg/l
Selenium	0.01 mg/l	Absent
Sulphate	1000 mg/l	< 250 mg/l
Radioactivity:		
Radium-226	3 pc/l	< 1 pc/l
Strontium-90	10 pc/l	< 2 pc/l
Gross beta activity in the known absence of strontium-90 and alpha-emitting radionuclides.	1000 pc/l	< 100 pc/l
Microbiological: (1)		
Enterococci (35°C)	< 40/100 ml	0/100 ml
Algae	No heavy growth of blue-green algae	

(1) The supply should be free of barnyard runoff and of effluent contamination from either man or animals. The geometric mean of sample results should not exceed the values given.

AGR-3 Irrigation

The suitability of water for irrigation cannot be defined precisely because the effects of the water on the crop being irrigated depend on many factors. These include: soil types, climatic conditions, irrigation practices, variations in the relation between the concentration and composition of the irrigation water and the soil solution, variations in the tolerance of different plants to the combined or individual constituents in the irrigation water or the soil solution, and the modifying effects of interrelations between and among the constituents. In general, for satisfactory irrigation, soils with poor drainage characteristics require water of higher quality than better drained soils.

In humid areas, excessive concentrations of salts or individual elements will normally be leached from the soil during periods of heavy rainfall or snowmelt before or after the growing season. This leaching action is another factor affecting the quality of water that can be used for irrigation. It may allow the use of water of poorer quality than that listed in these criteria for some crops and conditions without serious detrimental effects. Also through proper timing and adjustment of frequency and volumes of water applied, detrimental effects of poorer quality water may often be mitigated. Good drainage of soil may be a factor of similar importance as the quality of the water used.

The presence of sediment, pesticides, or pathogenic organisms in irrigation water, which may not specifically affect plant growth, may affect the acceptability of the product. Larger sediment particles could lead to plugging of sprinkler nozzles.

Although there are many variations in the quality of water that is suitable for specific irrigation uses, water quality criteria have been assembled as a guide to the quality of water that will meet many irrigation needs. The criteria are listed as permissible and desirable. Water meeting the desirable criteria should be satisfactory for irrigation of most crops in most soil types for long periods of time. Water meeting the permissible criteria, while suitable for many crops, soil and climatic conditions, could result in decreased yields for some crops if it is used repeatedly, unless there is dilution or leaching by precipitation or the application of excess irrigation water under favourable drainage conditions. Special crops or conditions, such as the growing of plants in greenhouses, may require irrigation with water of higher quality than that indicated by the desirable criteria.

The suitability of a given source of water for specific crops, soil types, and climatic conditions should be judged on an individual basis if its suitability has not been demonstrated by practice.

TABLE AGR-3

Water Quality Criteria for Agricultural Uses
Irrigation

Constituent or Characteristic	Permissible Criteria	Desirable Criteria
Physical:		
Temperature		55°F to 85°F
Microbiological: (1)		
Fecal Coliforms (44.5°C)	100/100 ml	0/100 ml
Enterococci (35°C)	20/100 ml	0/100 ml
Total bacteria (20°C)	100,000/100 ml	< 10,000/100 ml
Inorganic Chemicals:		
Aluminum	20.0 mg/l	< 1.0 mg/l
Arsenic	10.0 mg/l	< 1.0 mg/l
Beryllium	1.0 mg/l	< 0.5 mg/l
Boron	0.5 mg/l	0.3 mg/l
Cadmium	0.05 mg/l	< 0.005 mg/l
Chloride	150 mg/l	< 70 mg/l
Chloride—special requirement for tobacco	70 mg/l	< 20 mg/l
Chromium	20.0 mg/l	< 5.0 mg/l
Cobalt	10.0 mg/l	< 0.2 mg/l
Copper	5.0 mg/l	< 0.2 mg/l
Lead	20.0 mg/l	< 5.0 mg/l
Lithium	5.0 mg/l	< 5.0 mg/l
Manganese	20.0 mg/l	< 2.0 mg/l
Molybdenum	0.05 mg/l	< 0.005 mg/l
Nickel	2.0 mg/l	< 0.5 mg/l
pH (range)	4.8 to 9.0	
Residual Sodium Carbonate $=(CO_3^{--}+HCO_3^{-})-(Ca^{++}+Mg^{++})$ expressed as mg eq/l	1.25 mg eq/l	< 1.25 mg eq/l
Selenium	0.05 mg/l	< 0.05 mg/l
Sodium Adsorption Ratio $=\frac{Na^{+}}{\sqrt{\frac{Ca^{++}+Mg^{++}}{2}}}$ expressed as mg eq/l	6	< 4
Total dissolved solids		
Vanadium	500 mg/l	< 200 mg/l
Zinc	10.0 mg/l	< 10.0 mg/l
	5.0 mg/l	< 5.0 mg/l
Organic Chemicals:		
Pesticides	Insecticides, herbicides, fungicides, and rodenticides must not be present in waters used for irrigation in concentrations that are detrimental to crops, livestock, wildlife or man.	Absent

(1) The geometric mean of sample results should not exceed the values given.

2 WATER QUALITY CRITERIA FOR THE PROTECTION OF FISH, OTHER AQUATIC LIFE AND WILDLIFE (F & W)

The following criteria are considered to be satisfactory for fish, other aquatic life and wildlife. Reference is made to aspects of water quality considered to be most important in the light of current knowledge. Narrative guidelines are offered where quantification is not yet possible.

Dissolved Materials

Dissolved materials should not be added to increase the concentration of dissolved solids by more than one-third of the natural condition of the receiving water, owing to potentially harmful osmotic effects of high concentrations. Dissolved materials that are harmful in relatively low concentrations are discussed in the section "Toxic Substances".

pH, Alkalinity, Acidity

(1) pH should be maintained within a range of 6.5 to 8.5.

(2) To protect the carbonate system, and thus the productivity of the water, acid should not be added in sufficient quantity to lower the total alkalinity to less than 20 mg/l.

Temperature

(1) **General**

Unless a special study shows that discharge of a heated effluent into the hypolimnion of a lake will be desirable, such practice is not recommended and water for cooling should not be pumped from the hypolimnion to be discharged to the same body of water.

The normal daily and seasonal temperature variations that were present before the addition of heat due to other than natural causes should be maintained.

Wherever possible, heated discharges should be located where elevated temperature will enhance public utilization of the water by supporting a wider variety of water uses.

(2) **Great Lakes and Connecting Waters**

(a) Heated discharges are not permitted that may stimulate production of nuisance organisms or vegetation or that are or may become injurious to wildlife, waterfowl, fish or other aquatic life or the growth and reproduction thereof. For each discharge of a heated effluent, acceptable mixing zones will be established on the basis of features and facts pertinent to that specific situation.

(b) Heat may not be discharged in the vicinity of spawning areas or where increased water temperature might interfere with recognized movements of spawning or migrating fish populations.

(3) **Inland Waters**

(a) Heated discharges to inland waters will not be permitted unless it is clearly demonstrated that heated effluents will enhance the usefulness of the water resource without endangering the production and optimum maintenance of wildlife, fish and other aquatic species. It shall be the responsibility of the user to provide evidence to support the acceptability of the discharge under these terms.

(b) Inland trout streams, salmon streams, trout and salmon lakes and the hypolimnion of lakes and reservoirs containing salmonids and other cold water forms should not be warmed.

(c) Heat may not be discharged in the vicinity of spawning areas or where increased temperature might interfere with recognized movements of spawning or migrating fish populations.

Dissolved Oxygen

(1) **Warm-water Biota**

The dissolved oxygen (DO) concentration should be above 5 mg/l at all times, except that in certain situations concentrations may range between 5 and 4 mg/l for short intervals within any 24-hour period provided that water quality is favourable in all other respects.

(2) **Cold-water Biota**

In spawning areas, DO levels must not be below 7 mg/l at any time. Elsewhere, DO concentrations should not be below 6 mg/l. In certain situations, they may range between 6 and 5 mg/l for short intervals within any 24-hour period, provided the water quality is favourable in all other respects.

Carbon Dioxide

The 'free' carbon dioxide concentration should not exceed 25 mg/l.

Oil

Oil, petrochemicals or other immiscible substances that will cause visible films or toxic, noxious or nuisance conditions should not be added to water.

Turbidity

(1) Turbidity associated with waste inputs should not exceed 50 Jackson units in warm-water streams or 10 Jackson units in cold-water streams.

(2) There should be no discharge which would cause turbidities exceeding 25 Jackson units in warm-water lakes or 10 Jackson units in cold-water or oligotrophic lakes.

Settleable Materials

Substances should not be added that will adversely affect the aquatic biota or will create objectionable deposits on the bottom or shore of any body of water.

Colour and Transparency

For effective photosynthetic production of oxygen, it is required that 10 per cent of the incident light reach the bottom of any desired photosynthetic zone in which adequate dissolved oxygen concentrations are to be maintained.

Floating Materials

All floating materials, other than those of natural origin, should be excluded from streams and lakes.

Tainting substances

All materials that will impart odour or taste to fish or edible invertebrates should be excluded from receiving waters at levels that produce tainting.

Radionuclides

Radioactive materials should not be present in natural waters as a consequence of failure to exercise necessary controls of radioactivity releases to keep exposure to a minimum.

Experience has shown that standards established for drinking water assure that people will receive no more than currently acceptable amounts of radioactive materials from aquatic sources and that fish and other aquatic life will not receive an injurious dose of radiation.

Thus, present standards accepted for the protection of fish and other aquatic life are as follows:

	pc/l
Gross beta emitters	1000
Radium-226	3
Strontium-90	10

Where other radioisotopes occur, the significance of the exposure of aquatic species to these forms of radiation should be assessed for each situation, both with respect to potential damage to the organisms themselves and to humans where fish or other edible forms are utilized.

Plant Nutrients and Nuisance Growths

(1) Nutrients from unnatural sources that will stimulate production of algae, nuisance vegetation or offensive slime growths should not be added to water. The addition of sulphates or manganese oxide to a lake should be limited if iron is present in the hypolimnion as these substances may increase the quantity of available phosphorus.

(2) Organic or other materials that will promote an increased zone of anaerobic decomposition within a lake, reservoir or other body of water should not be allowed to enter the water.

(3) The naturally-occurring ratios of nitrogen (particularly NO_3 and NH_4) to total phosphorus, and their amounts, should not be radically changed by the addition of materials from waste sources and land drainage.

Toxic Substances

Toxic substances must not be added to water in concentrations or combinations that are toxic or harmful to human, animal, plant or aquatic life, except where the application of approved substances for the control of nuisance organisms has been authorized by the Commission (Section 28b, OWRC Act).

The evaluation of toxicity for aquatic organisms is based on use of the TLm or median tolerance limit. This represents the concentration at which half the test organisms will succumb over a given period of exposure such as 24, 48 or 96 hours. It does not, therefore, represent the safe concentration and an application factor is applied to ensure a safe condition, including allowance for sub-lethal effects.

(1) **Substances of Unknown Toxicity**

All effluents containing foreign materials should be considered harmful and not permissible until bioassay tests have shown otherwise. The onus for demonstrating that an effluent is harmless in the concentrations to be found in the receiving waters rests with those responsible for the discharge. Information concerning acceptable bioassay procedures is available from the Commission.

(2) **Application Factors**

Concentration of materials that are non-persistent (that is, have a half-life of less than 96 hours), or have non-cumulative effects after mixing with the receiving waters, should not exceed 1/10 of the applicable 96-hour TLm value at any time or place based on species representative of local conditions. The 24-hour average of the concentration of these materials should not exceed 1/20 of the TLm value after mixing. For other toxicants, the concentrations should not exceed 1/20 and 1/100 of the TLm value under the aforementioned conditions.

(3) **Additive Effects**

When two or more toxic materials that have additive effects are present at the same time in the receiving water, some reduction is necessary in the permissible concentrations as derived from bioassays on individual substances or wastes. The amount of reduction required is a function of both the number of toxic materials present and their concentrations in respect to the derived permissible concentration. An appropriate means of assuring that the combined

amounts of the several substances do not exceed a permissible concentration for the mixture is through the use of the following relationship:

$$\left(\frac{C_a}{L_a} + \frac{C_b}{L_b} \ldots + \frac{C_n}{L_n} \leq 1\right)$$

where C_a, C_b, ... C_n are the measured concentrations of the several toxic materials in the water and L_a, L_b, ... L_n are the respective permissible concentration limits derived for the materials on an individual basis. Should the sum of the several fractions exceed one, then a local restriction on the concentration of one or more of the substances is necessary.

(4) **Pesticides**

(a) Chlorinated Hydrocarbons:

Any addition of chlorinated hydrocarbon insecticides is likely to cause damage to some desired organisms and their use should be avoided.

(b) Other Chemical Pesticides:

Other pesticides and herbicides gaining access to water can cause damage to desirable organisms and should be used with utmost discretion and caution. Tables F & W-1 and F & W-2 list the 48-hour TLm values of a number of pesticides for various types of fresh water organisms. To provide reasonably safe concentrations of these materials in receiving waters, application factors ranging from 1/10 to 1/100 should be used, with these values depending on the characteristic of the pesticide in question and used as specified in (2) above. Concentrations thus derived may be considered tentatively safe under the conditions specified. TLm values and related application factors are subject to revision as additional bioassay information is obtained for species which may be more representative of local conditions.

(5) **Other Toxic Substances**

(a) ABS: The concentration of ABS should not exceed 1/7 of the 48-hour TLm at any time or place.

(b) LAS: The concentration of LAS should not exceed 1/7 of the 48-hour TLm at any time or place.

(c) ARSENIC: An application factor of 1/100 should be applied to the 96-hour TLm value as a tentative safe concentration for continuous exposure. An environmental level of .01 mg/l should not be exceeded under any circumstances.

(d) AMMONIA: Permissible concentrations of ammonia should be determined by the flow-through bioassay with the pH of the test solution maintained at 8.5, DO concentrations between 4 and 5 mg/l, and temperatures near the upper allowable levels.

(e) CADMIUM: The concentration of cadmium must not exceed 1/500 of the 96-hour TLm concentration at any time or place.

(f) CHROMIUM: The concentration of chromium should not exceed 1/100 of the 96-hour TLm at any time or place.

(g) COPPER: The maximum copper (expressed as Cu) concentration at any time or place shall not be greater than 1/12 of the 96-hour TLm value. The maximum permissible concentration for continuous exposure is between 3 per cent and 7 per cent of the 96-hour TLm.

(h) LEAD: The concentration of lead should not exceed 1/20 of the 96-hour TLm at any time or place and the 24-hour average should not exceed 1/100 of the 96-hour TLm concentration after mixing.

(i) MERCURY: Owing to demonstrated cumulative effects of mercury in fish, and the attendant hazard to other animals, discharges of mercury to water should be avoided.

(j) NICKEL: The concentration of nickel should not exceed 1/50 of the 96-hour TLm concentration at any time or place.

(k) ZINC: The concentration of zinc should not exceed 1/100 of the 96-hour TLm concentration at any time or place.

TABLE F & W-1 INSECTICIDES*

(48-hour TLm values from static bioassay, in micrograms per litre. Exceptions are noted.)

Pesticide	Stream Invertebrate[1] Species	TLm	Cladocerans[2] Species	TLm	Fish[3] Species	TLm	Gammarus Lacustris,[4] TLm
Abate	Pteronarcys californica	100			Brook trout	1,500	640
Aldrin[5]	P. californica	8	Daphnia pulex.	28	Rainbow trout	3	12,000
Allethrin	P. californica	28	D. pulex	21	- do -	19	20
Azodrin					- do -	7,000	
Aramite			D. magna	345	Bluegill	35	100
Baygon[5]	P. californica	110			Fathead	25	50
Baytex[5]	P. californica	130	Simocephalus serrulatus	3.1	Brown t.	80	70
Benzene hexachloride (lindane)	P. californica	8	D. pulex	460	Rainbow t.	18	88
Bidrin	P. californica	1900	D. pulex	600	- do -	8,000	790
Carbaryl (sevin)	P. californica	1.3	D. pulex	6.4	Brown t.	1,500	22
Carbophenothion (trithion)			D. magna	0.009	Bluegill	225	28
Chlordane[5]	P. californica	55	S. serrulatus	20	Rainbow t.	10	80
Chlorobenzilate			S. serrulatus	550	- do -	710	
Chlorthion			D. magna	4.5			
Coumaphos			D. magna	1			0.14
Cryolite			D. pulex	5,000	Rainbow t.	47,000	
Cyclethrin			D. magna	55			
DDD (TDE)[5]	P. californica	1100	D. pulex	3.2	Rainbow t.	9	1.8
DDT[5]	P. californica	19	D. pulex	0.36	Bass	2.1	2.1
Delnav (dioxathion)					Bluegill	14	690
Delmeton (systex)				14	- do -	81	
Diazinon[5]	P. californica	60	D. pulex	0.9	- do -	30	500
Dibrom (naled)	P. californica	16	D. pulex	3.5	Brook t.	78	160
Dieldrin[5]	P. californica	1.3	D. pulex	240	Bluegill	3.4	1,000
Dilan			D. magna	21	- do -	16	600
Dimethoate (cygon)	P. californica	140	D. magna	2500	- do -	9600	400
Dimethrin					Rainbow t.	700	
Dichlorvos[5] (DDVP)	P. californica	10	D. pulex	0.07	Bluegill	700	1
Disulfoten (di-syston)	P. californica	18			- do -	40	70

* From Report of the Committee on Water Quality Criteria, Federal Water Pollution Control Administration, U.S. Department of the Interior (1968).

TABLE F & W-1—continued

Pesticide	Stream Invertebrate[1] Species	TLm	Cladocerans[2] Species	TLm	Fish[3] Species	TLm	Gammarus Lacustris,[4] TLm
Dursban	Peteronareella badia	1.8			Rainbow t.	20	0.4
Endosulfan (thiodan)	P. californica	5.6	D. magna	240	- do -	1.2	64
Endrin[5]	P. californica	0.8	D. pulex	20	Bluegill	0.2	4.7
EPH			D. magna	0.1	- do -	17	36
Ethion	P. californica	14	D. magna	0.01	- do -	230	3.2
Ethyl guthion[5]			D. pulex		Rainbow t.		
Fenthion	P. californica	39	D. pulex	4			
Guthion[5]	P. californica	8	D. magna	0.2	Rainbow t.	10	0.3
Heptachlor[5]	P. badia	4	D. pulex	42	- do -	9	100
Kelthane (dicofel)	P. californica	3000	D. magna	390	- do -	100	
Kepone					- do -	37.5	
Malathion[5]	P. badia	6	D. pulex	1.8	Brook t.	19.5	1.8
Methoxychlor[6]	P. californica	8	D. pulex	0.8	Rainbow t.	7.2	1.3
Methyl parathion[5]			D. magna	4.8	Bluegill	8000	
Morestan	P. californica	40			- do -	96	
Ovex	P. californica	1500			- do -	700	
Paradichlorobenzene					Rainbow t.	880	
Parathion[5]	P. californica	11	D. pulex	0.4	Bluegill	47	6
Perthane			D. magna	9.4	Rainbow t.	7	
Phosdrin[5]	P. californica	9	D. pulex	0.16	- do -	17	310
Phosphamidon	P. californica	460	D. magna	4	- do -	8000	3.8
Pyrethrins	P. californica	64	D. pulex	25	- do -	54	18
Rotenone	P. californica	900	D. pulex	10	Bluegill	22	350
Strobane[5]	P. californica	7			Rainbow t.	2.5	
Tetradifon (tedion)					Bluegill	1100	140
TEPP[5]					Fathead	390	52
Thanite			D. magna	450			
Thimet					Bluegill	5.5	70
Toxaphene[5]	P. californica	7	D. pulex	15	Rainbow t.	2.8	70
Trichlorofon (dipterex)[5]	P. badia	22	D. magna	8.1	- do -	160	60
Zectran	P. californica	16	D. pulex	10	- do -	8000	76

TABLE F & W-2

HERBICIDES, FUNGICIDES, DEFOLIANTS, ALGICIDES*

Pesticide	Stream Invertebrate[1] Species	TLm	Cladocerans[2] Species	TLm	Fish[3] Species	TLm	Gammarus Lacustris,[4] TLm
Ametryne					Rainbow t.	3400	
Aminotriazole							
Aquathol					Bluegill	257	
Atrazine			Daphnia magna	3600	Rainbow t.	12,600	
Azide, potassium					Bluegill	1400	10,000
Azide, sodium					- do -	980	9000
Copper chloride					- do -	1100	
Copper sulphate					- do -	150	
Dichlobenil	Pteronarcys californica	44,000	Daphnia pulex	3700	- do -	20,000	1500
2,4-D PGBEE			D. pulex	3200	Rainbow t.	960	1800
2,4-D BEE	P. californica	1800			Bluegill	2100	760
2,4-D isopropyl					- do -	800	
2,4-D butyl ester					- do -	1300	
2,4-D butyl + isopropyl ester					- do -	1500	
2,4,5-T isooctyl ester					- do -	16,700	
2,4,5-T isopropyl ester					- do -	1700	
2,4,5-T PGBE					- do -	560	
2(2,4-DP) BEE					- do -	1100	
Dalapon	P. californica Very low toxicity		D. magna	6000		Very Low Toxicity	
Dead-X	P. californica	5000	D. pulex	3700	Rainbow t.	9400	5600
DEF	P. californica	2300			Bluegill	36	230
Dexon	P. californica	42,000			Bluegill	23,000	6000
Dicamba					non-toxic		5800
Dichlone			D. magna	26	Rainbow t.	48	11,500
Difolitan	P. californica	150			Channel Cat	31	6500
Dinitrocresol	P. californica	560			Rainbow t.	210	
Diquat					Rainbow t.	12,300	
Diuron	P. californica	2800	D. pulex	1400	- do -	4300	380
Du-ter					Bluegill	33	
Dyrene			D. magna	490		15	
Endothal, copper					Rainbow t.	290	

* From Report of the Committee on Water Quality Criteria, Federal Water Pollution Control Administration, U.S. Department of the Interior (1968).

TABLE F & W-2—continued

Pesticide	Stream Invertebrate[1] Species	TLm	Cladocerans[2] Species	TLm	Fish[3] Species	TLm	Gammarus Lacustris,[4] TLm
Endothal dimethylamine					Rainbow t.	1150	
Fenac, acid	P. californica	70,000			- do -	16,500	
Fenac, sodium	P. californica	80,000	D. pulex	4500	- do -	7500	18,000
Hydram (molinate)	P. californica	3500			- do -	290	
Hydrothol 191					- do -	690	1000
Lanstan (Korax)					- do -	100	5500
LFN					- do -	79	
Paraquat	P. californica Very low toxicity		D. pulex	3700	Very low toxicity		18,000
Propazine					Rainbow t.	7800	
Silvex, PGBEE			D. pulex	2000	- do -	650	
Silvex, isoctyl					Bluegill	1400	
Silvex, BEE					- do -	1200	
Simazine	P. californica	50,000			Rainbow t.	5000	21,000
Sodium arsenite	P. californica Very low toxicity		Simocephalus serrulatus	1400	- do -	36,500	
Tordon (picloram)					- do -	2500	48,000
Trifuralin	P. californica	4200	D. pulex	240	- do -	11	5600
Vernam[5] (vernolate)					- do -	5900	25,000

1 Stonefly bioassay was done at Denver, Colo., and at Salt Lake City, Utah. Denver tests were in soft water (35 mg/l TDS), non-aerated, 60 F. Salt Lake City tests were in hard water (150 mg/l TDS), aerated, 48-50 F. Response was death.

2 Daphnia pulex and Simocephalus serrulatus bioassay was done at Denver, Colo., in soft water (35 mg/l TDS), non-aerated, 60 F. Daphnia magna bioassay was done at Pennsylvania State University in hard water (146 mg/l TDS), non-aerated, 68 F. Respone was immobilization.

3 Fish bioassay was done at Denver, Colo., and at Rome N.Y. Denver tests were with 2-inch fish in soft water (35 mg/l TDS), non-aerated, trout at 55 F.; other species at 65 F. Rome tests were with 2-2½ inch fish in soft water (6 mg/l TA: pH 5.85-6.4), 60 F. Response was death.

4 Gammarus bioassay was done at Denver, Colo., in soft water (35 mg/l TDS), non-aerated, 60 F. Response was death.

5 Becomes bound to soil when used according to directions, but highly toxic (reflected in numbers) when added directly to water.

3 WATER QUALITY CRITERIA FOR INDUSTRIAL WATER SUPPLIES (IWS)

Desired water quality criteria are tabled for the major industrial classifications as follows:

Brewing and Soft Drinks	— IWS-1
Chemical and Allied Products	— IWS-2
Industrial Cooling	— IWS-3
Food Processing	— IWS-4
Electroplating and Metal Finishing	— IWS-5
Iron and Steel	— IWS-6
Petroleum	— IWS-7
Pulp and Paper	— IWS-8
Leather Tanning and Finishing	— IWS-9
Textiles	— IWS-10

While the values listed should not normally be exceeded, these water quality criteria can vary considerably for the same industrial process depending on factors such as the technological age of plant design.

A raw surface water and/or ground water supply which is used by many different industries may not satisfy the widely varying criteria for each use. However, water treatment technology in its present state of development permits the utilization of surface water of literally any available quality to produce water of any desired quality at the point of use in industry.

Most industries located on municipal water supply systems find the quality of water provided to be satisfactory. If the water quality requirements of an industry are such that water of higher quality than that provided by the municipality is required for specific process use, the industry generally accepts the additional costs involved to produce the higher quality water.

TABLE IWS-1

WATER QUALITY CRITERIA FOR THE BREWING AND SOFT DRINK INDUSTRIES

(Unless otherwise indicated, units are mg/l)

Characteristic	Concentration
Alkalinity ($CaCO_3$)	85
pH, units	(1)
Hardness ($CaCO_3$)	(1)
Chloride (Cl)	250[2]
Sulphate (SO_4)	250[2]
Iron (Fe)	0.3[3]
Manganese (Mn)	0.05
Fluoride (F)	1[3]
Dissolved solids	(1)
Organics: carbon chloroform extract (CCE)	0.15[3]
Coliform bacteria, count/100 ml	(3)
Colour, units	5[4]
Taste, threshold number	(4, 5)
Odour, threshold number	(4, 5)

(1) Controlled by treatment for other constituents.
(2) For brewing, value should not exceed 100 mg/l.
(3) Not greater than OWRC Drinking Water Objectives.
(4) In general, public water supplies are given conventional treatment such as coagulation, filtration and chlorination. Any additional requirement for higher quality, for example, deionized water, is the responsibility of the industry. To ensure low organic content, activated carbon treatment is used by industry.
(5) Zero, not detectable by test.

TABLE IWS-2

WATER QUALITY CRITERIA FOR THE CHEMICAL AND ALLIED PRODUCTS INDUSTRIES*

(Unless otherwise indicated, units are mg/l)

Characteristic	Concentration[1]
Alkalinity (as $CaCO_3$)	150
Iron (Fe)	0.3
Manganese (Mn)	0.1
Calcium (Ca)	50
Magnesium (Mg)	25
Bicarbonate (HCO_3)	250
Sulphate (SO_4)	250
Chloride (Cl)	250
Nitrate (NO_3) as N	10
Hardness (as $CaCO_3$)	250
pH, units	6.5-8.5
Dissolved solids	750
Silica	50
Colour, units	20
Suspended solids	15

* Industries include the manufacture of synthetic rubber, plastics, fertilizers, soap and detergents, organic and inorganic chemicals, etc.
(1) Because of the varying requirements of the many uses in the vast number of chemical industries, more stringent restrictions are placed on several of the above noted characteristics. In some cases, any concentration can be handled, while in others, the raw water is accepted as received provided it meets total solids or other limiting values. The above concentrations are suggested guidelines that should be suitable for the majority of uses in the chemical industry.

TABLE IWS-3

WATER QUALITY CRITERIA FOR COOLING WATER*

(Unless otherwise indicated, units are mg/l)

Characteristic	Concentration
Turbidity	50
Hardness	50
Iron	0.5
Manganese	0.5

- Cooling waters should have appropriate initial temperatures and should not deposit scale, be corrosive or encourage the growth of slimes. Among the constituents of natural water that may prove detrimental to its use for cooling purposes are hardness, suspended solids, dissolved gases, acids, oil and other organic compounds and slime-forming organisms.

TABLE IWS-4

WATER QUALITY CRITERIA FOR THE FOOD PROCESSING INDUSTRY

(Unless otherwise indicated, units are mg/l)

Characteristic	Concentration
Alkalinity ($CaCO_3$)	150
pH, units	6.5-8.5
Hardness ($CaCO_3$)	150
Chloride (Cl)	250
Sulphate (SO_4)	250
Iron (Fe)	0.2
Manganese (Mn)	0.2
Chlorine (Cl)	(1)
Fluoride (F)	1 (2)
Silica (SiO_2)	50
Phenol	(3, 4)
Nitrate (NO_3) as N	10 (2)
Nitrite (NO_2) as N	(3)
Organics:	
Carbon chloroform extract (CCE)	0.15
Odour, threshold number	(3)
Taste, threshold number	(3)
Turbidity	(6)
Colour, units	5
Dissolved solids	500
Suspended solids	10
Coliform, count/100 ml	(6)
Total bacteria, count/100 ml	(7)

(1) Process waters for food canning are purposely chlorinated to a selected, uniform level. An unchlorinated supply must be available for preparation of canning syrups.

(2) Waters used in the processing and formulation of foods for babies should be low in fluorides concentration. Also, because high nitrate intake is alleged to be involved in infant illnesses, the concentration of nitrates in waters used for processing baby foods should be low.

(3) Zero, not detectable by test.

(4) Because chlorination of food processing waters is a desirable and widespread practice, the phenol content of intake waters must be considered. Phenol and chlorine in water can react to form chlorophenol, which even in trace amounts can impart a medicinal off-flavour to foods.

(5) Maximum permissible concentration may be lower depending on type of substance and its effect on odour and taste.

(6) As required by OWRC Drinking Water Objectives.

(7) The total bacterial count must be considered as a quality requirement for waters used in certain food processing operations. Other than aesthetic considerations, high bacterial concentration in waters coming in contact with frozen foods may significantly increase the count per gram for the food. Waters used to cool heat-sterilized cans or jars of food must be low in total count for bacteria to prevent serious spoilage due to aspiration of organisms through container seams. Chlorination is widely practised to assure low bacterial counts on container cooling waters.

WATER QUALITY CRITERIA FOR THE ELECTRO-PLATING AND METAL FINISHING INDUSTRIES — IWS-5

Plating-room processes that utilize water include the stripping or pickling operations, cleaning by organic solvents or alkaline solutions, rinsing, and electrochemical plating. For acid stripping or for alkaline cleaning, the quality of water used in the baths is seldom critical, for the added chemicals far outweigh the natural constituents of the water. Hardness of water may be detrimental when soaps or alkaline cleaning agents are used.

For rinsing and for plating, water quality is frequently a major problem. High quality water is of primary importance to assure satisfactory finished work. For decorative plating, water spots and stains may necessitate reworking, wiping, buffing, and other laborious operations. Before the application of any organic corrosion-resistant coating, it is almost a necessity to use demineralized water in the final rinse, in order to achieve adhesion of the coating. A high concentration of dissolved solids is especially detrimental in rinse waters.

In plating baths, iron, aluminum, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulphide, sulphite, sulphate, fluoride, chloride, silicate, copper, and lead have been reported to cause difficulties under certain conditions. Considerable evaporation occurs from plating baths and hence the ions present in the make-up water are concentrated to the extent that they are troublesome.

Calcium and magnesium are especially troublesome in plating baths, for they tend to precipitate to form scale on the heated surface or a sludge in the water. There is a probability of these precipitates being included in the electro-deposit, causing pits, porosity, and roughness. Magnesium may also reduce the "throwing power" in chromium baths, but on the other hand, magnesium sulphate is sometimes added to nickel-plating baths to produce softer deposits, to minimize certain types of pitting, and to increase throwing power.

Sodium and potassium are generally not harmful in plating operations, although sodium may cause brittle deposits in nickel baths or reduce the throwing power in chromium solutions. Iron is one of the most troublesome pollutants of many plating operations. In a nickel-sulphate bath, it may cause hazy, streaked, pitted, or brittle deposits; in acid copper solutions, it produces rough deposits; in chromium baths, it reduces the throwing power; in

cadmium cyanide, it causes hazy deposits; in silver cyanide, stained deposits; and in zinc sulphate baths it lowers the plating efficiency and the protective value of the coating.

Among the anions, bicarbonates are detrimental in heated alkaline baths, for they tend to be converted to carbonates and accelerate the precipitation of calcium. Moreover, they buffer the water and require higher dosages of acid or alkali to obtain the desired pH value. Chlorides have been reported to cause rough, modular, iridescent, and crystalline deposits in cadmium, copper, silver, and tin baths respectively. Organic substances reduce chromium, and cause rough, hazy, streaked, coloured, or pitted deposits under various conditions. Colour and turbidity are similarly objectionable.

Abstracted from "Water Quality Criteria", 2nd Edition, State Water Quality Control Board, California, Publication No. 3-A

TABLE IWS-6

WATER QUALITY CRITERIA FOR THE IRON AND STEEL INDUSTRY

(Unless otherwise indicated, units are mg/l)

Characteristic	Quenching, hot rolling, gas cleaning	Cold rolling	Selected rinse waters	
			Softened	Demineralized
Suspended solids	25	10	(2)	(2)
Dissolved solids	(1)	(1)	(1)	(2)
Alkalinity ($CaCO_3$)	(3)	(3)	(3)	(2)
Hardness ($CaCO_3$)	(3)	(3)	100	(2)
pH, units	6.0-9.0	6.0-9.0	6.0-9.0	(3)
Chloride (Cl)	150	150	150	(2)
Dissolved oxygen (O_2)	(4)	(4)	(4)	(4)
Temperature, °F	100	100	100	100
Oil	(1)	(2)	(2)	(2)
Floating material	(1)	(2)	(2)	(2)

(1) Accepted as received if meeting total solids or other limiting values.

(2) Zero, not detectable by test.

(3) Controlled by treatment for other constituents.

(4) Minimum to maintain aerobic conditions.

TABLE IWS-7

WATER QUALITY CRITERIA FOR THE PETROLEUM INDUSTRY

(Unless otherwise indicated, units are mg/l)

Characteristic	Concentration
Silica (SiO_2)	(1)
Iron (Fe)	1
Calcium (Ca)	75
Magnesium (Mg)	25
Bicarbonate (HCO_3)	(1)
Sulphate (SO_4)	(1)
Chloride (Cl)	200
Fluoride (F)	(1)
Nitrate (NO_3) as N	(1)
Dissolved solids	750
Suspended solids	10
Hardness ($CaCO_3$)	350
Noncarbonate hardness ($CaCO_3$)	70
Colour, units	(1)
pH, units	6.0-9.0

(1) Accepted as received if meeting total solids or other limiting values.

TABLE IWS-8

WATER QUALITY CRITERIA FOR THE PULP AND PAPER INDUSTRY

(Unless otherwise indicated, units are mg/l)

Characteristic	Mechanical Pulping	Chemical Pulp and Paper	
		Unbleached	Bleached
Silica (SiO_2)	(1)	50	50
Aluminum (Al)	(1)	(1)	(1)
Iron (Fe)	0.3	1.0	0.1
Manganese (Mn)	0.1	0.1	0.05
Zinc (Zn)	(1)	(1)	(1)
Calcium (Ca)	(1)	20	20
Magnesium (Mg)	(1)	10	10
Sulphate (SO_4)	(1)	(1)	(1)
Chloride (Cl)	500	200	200
Dissolved solids	(1)	(1)	(1)
Suspended solids	(1)	10[2]	10[2]
Hardness ($CaCO_3$)	(1)	100	100
pH, units	6.0-9.0	6.0-9.0	6.0-9.0
Colour, units	30	30	10
Temperature, °F	(1)	(1)	95

(1) Accepted as received if meeting total solids or other limiting values.

(2) No gritty or colour-producing solids.

TABLE IWS-9

WATER QUALITY CRITERIA FOR THE LEATHER TANNING AND FINISHING INDUSTRY

(Unless otherwise indicated, units are mg/l)

Characteristic	Tanning Processes	General Finishing Processes	Colouring
Alkalinity ($CaCO_3$)	(1)	130	130
pH, units	6.0-8.0	6.0-8.0	6.0-8.0
Hardness ($CaCO_3$)	150	(2)	(3, 4)
Calcium (Ca)	60	(2)	(3, 4)
Chloride (Cl)	250	250	(5)
Sulphate (SO_4)	250	250	(5)
Iron (Fe)	0.3	0.3	0.1
Manganese (Mn)	0.2	0.2	0.01
Organics:			
Carbon chloroform extract (CCE)	(5)	0.2	(3)
Colour, units	5	5	5
Coliform bacteria, count/100 ml	(6)	(6)	(5)
Turbidity	(3)	(3)	(3)

(1) Accepted as received if meeting total solids or other limiting values.
(2) Lime softened.
(3) Zero, not detectable by test.
(4) Demineralized or distilled water.
(5) Concentration not known.
(6) OWRC Drinking Water Objectives.

TABLE IWS-10

WATER QUALITY CRITERIA FOR THE TEXTILE INDUSTRY

(Unless otherwise indicated, units are mg/l)

Characteristic	Sizing Suspension	Scouring	Bleaching	Dyeing
Iron (Fe)	0.3	0.1	0.1	0.1
Manganese (Mn)	0.05	0.01	0.01	0.01
Copper (Cu)	0.05	0.01	0.01	0.01
Dissolved solids	100	100	100	100
Suspended solids	5	5	5	5
Hardness ($CaCO_3$)	25	25	25	25
pH, units:				
Cotton	6.5-10.0	9.0-10.5	2.5-10.5	7.5-10.0
Synthetics	6.5-10.0	3.0-10.5	(1)	6.5-7.5
Wool	6.5-10.0	3.0-5.0	2.5-5.0	3.5-6.0
Colour, units	5	5	5	5

(1) Not applicable.

4 CRITERIA FOR PUBLIC WATER SUPPLIES (PWS)

Criteria are given for public and private supplies from both surface and ground water sources.

Public supplies include water systems operated by municipalities, public utilities, industries, commissions, commercial establishments, etc. where competent operation of the water supply system is provided.

Private supplies include water systems operated by personnel who may not have the necessary technical or mechanical expertise.

PWS-1 Criteria for Public Surface Water Supplies

Since treatment processes exist which can convert any raw water (with a few minor exceptions) to potable water, it is necessary to define a commonly accepted treatment system which can produce a potable water at a reasonable cost. For the purposes of these criteria, such a system has been defined to consist of coagulation, flocculation, sedimentation and rapid sand filtration; the use of chemicals is restricted by definition to the commonly used coagulants and chlorine for disinfection.

Two types of criteria have been established, namely the Permissible Criteria and the Desirable Criteria (Table PWS-1). Waters meeting both of these criteria are acceptable for treatment by the defined treatment process stated above. Waters meeting the Desirable Criteria provide for a greater margin of safety.

It should be borne in mind that the values given under the Permissible Criteria cannot be considered as maximum single sample values. These criteria should not be exceeded over substantial portions of time. If this should occur, then it will become necessary to determine the cause and initiate corrective action. The frequency and variety of sampling should be based on the findings of a comprehensive pollution survey.

TABLE PWS-1

WATER QUALITY CRITERIA FOR PUBLIC SURFACE WATER SUPPLIES

(Unless otherwise indicated, units are mg/l)

Constituent or Characteristic	Permissible Criteria	Desirable Criteria
Physical		
Colour (platinum-cobalt)	75 units	< 5 units
Odour	Readily removable by defined treatment	Absent
Turbidity	— do —	Absent
Temperature	85°F	Pleasant tasting
Inorganic Chemicals		
Ammonia	0.5 (as N)	< 0.01
Arsenic*	0.05	Absent
Barium*	1.0	Absent
Boron*	1.0	Absent
Cadmium*	0.01	Absent
Chloride*	250	< 25
Chromium* (hexavalent)	0.05	Absent
Copper*	1.0	Virtually absent
Dissolved Oxygen	≥ 4 (monthly mean) ≥ 3 (individual sample)	Near saturation
Fluoride*	See footnote (1)	1.0
Hardness*	Acceptable levels will vary with local hydrogeologic conditions and consumer acceptance.	
Iron (filterable)	0.3	Virtually absent
Lead*	0.05	Absent
Manganese* (filterable)	0.05	Absent
Nitrate plus Nitrite*	10 (as N)	Virtually absent
pH range	6.0 - 8.5 units	Least amount of interference with treatment process
Phosphorus* (phosphates)	Not encourage growth of algae or interfere with treatment process	
Selenium*	0.01	Absent
Silver*	0.05	Absent
Sulphate*	250	< 50
Total Dissolved Solids* (filterable residue)	500	< 200
Uranyl Ion*	5	Absent
Zinc*	5	Virtually absent
Organic Chemicals(2)		
Carbon chloroform extract* (CCE)	0.15	< 0.04
Cyanide*	0.20	Absent
Methylene blue active substances*	0.5	Virtually absent
Oil and grease*	Virtually absent	Absent

Table PWS-1 (cont.)

Constituent or Characteristic	Permissible Criteria	Desirable Criteria
Pesticides:		
Aldrin*	0.017	— do —
Chlordane*	0.003	— do —
DDT*	0.042	— do —
Dieldrin*	0.017	— do —
Endrin*	0.001	— do —
Heptachlor*	0.018	— do —
Heptachlor epoxide*	0.018	— do —
Lindane*	0.056	— do —
Methoxychlor*	0.035	— do —
Organic phosphates plus carbamates*	0.1	— do —
Toxaphene*	0.005	— do —
Herbicides:		
2,4-D plus 2,4,5-T, plus 2,4,5-TP*	0.1	— do —
Phenolic Substances*	Virtually absent	— do —
Radioactivity	(pc/l)	(pc/l)
Gross beta*	1,000	< 100
Radium-226*	3	< 1
Strontium-90*	10	< 2
Microbiological [3]		
Coliform organisms (at 35°C)	5,000/100 ml	< 100/100 ml
Fecal coliforms (44.5°C)	500/100 ml	< 10/100 ml
Fecal streptococci (35°C)	50/100 ml	< 1/100 ml
Total Bacteria (20°C)	100,000/100 ml	< 1,000/100 ml
Clostridia (in water) (35°C)	50/100 ml	0/100 ml

* The defined treatment process has little effect on the constituents.

(1)

Annual Avg. of Max. Daily Air Temp. F.	Recommended Limit for Fluoride mg/l
50.0 to 53.7	1.7
53.8 to 58.3	1.5
58.4 to 63.8	1.3

(2) Organic chemicals should not be present in concentrations as to cause adverse tastes and odours which cannot be removed by the defined treatment and/or by chlorination only.

(3) A monthly geometric mean of the results of raw water samples collected on a weekly basis (minimum of one sample per week) should be less than the numbers given under the Permissible Criteria column. These figures do not imply a relationship between bacterial groups.

PWS-2 Criteria for Public Ground Water Supplies

With the exception of dissolved oxygen, fluorides and microbiological criteria, the water quality criteria for surface water apply to ground water supplies.

For fluorides, hydrogen sulphide and pollution indicator organisms, the following apply to ground water supplies:

	Permissible Criteria	Desirable Criteria
	(Unless otherwise indicated, units are mg/l)	
Fluoride	2.4	1.0
Hydrogen Sulphide	0.1	Absent
Pollution Indicator Organisms	Coliform and other pollution indicator organisms should be virtually absent from all ground water supplies.	

It is considered desirable to provide the maximum of treatment — chlorination — for all ground water supplies. This measure ensures that nuisance organisms which exist in virtually all waters do not get the opportunity to develop a foothold in a water distribution system and thereby create objectionable conditions.

PWS-3 Criteria for Private Water Supplies

The raw water available to private supplies such as individual dwellings, cottages, farms, etc, must be of such quality that it can be used in the raw state or be made acceptable for use with a minimum of treatment limited to disinfection, filtration and/or softening. Economic considerations and lack of technical/mechanical expertise will prohibit the use of raw water supplies that require extensive treatment.

Some surface supplies have turbidities, colour and other undesirable constituents in excess of what can be used effectively in home or farm operations. Some ground water supplies (wells and springs) harbour objectionable gases, nuisance bacteria, in addition to having high concentrations of iron and being highly mineralized. The initial approach in establishing a private water supply should be to explore the ground water potential from the aspects of both quality and quantity. In many instances, deficiencies in ground water quality can be offset at a relatively low cost compared to that for surface waters.

Criteria for private water supplies are identical to the surface water criteria for public water supplies, with the exception of fluorides, hydrogen sulphide, physical and microbiological characteristics. For fluorides and hydrogen sulphide, the applicable criteria appear in Section PWS-2.

Physical Criteria:

The water supply should be substantially free from substances offensive to sight, taste or smell. Threshold odour values in excess of three units are generally considered objectionable.

Colour in the water supply should not exceed 15 units (platinum-cobalt scale).

Turbidity should be less than five units. Turbidities of up to 20 units may be removed relatively easily by sand or diatomaceous earth filters.

Microbiological Criteria:

Microorganisms	Permissible Criteria		Desirable Criteria
	Chlorination only	Chlorination & Filtration	No Treatment
Coliforms (35°C)	100/100 ml	400/100 ml	0/100 ml
Fecal Coliforms (44.5°C)	10/100 ml	40/100 ml	0/100 ml
Enterococci (35°C)	1/100 ml	4/100 ml	0/100 ml
Total Bacteria (20°C)	1000/100 ml	4000/100 ml	10/100 ml
Clostridia (in water) (35°C)	0/100 ml	4/100 ml	0/100 ml

Raw water samples should be collected at least monthly. The Geometric Mean of sample results should not exceed the values given in the table above.

5 CRITERIA OF WATER QUALITY FOR AESTHETICS AND RECREATION (A & R)

All surface waters should be capable of supporting life forms of aesthetic value. The positive aesthetic and recreational values of water should be attained through continuous enhancement of water quality. Surface waters should be of such quality as to provide for the enjoyment of recreational activities such as hunting and fishing which are based on the utilization or consumption of fish, waterfowl and other forms of life.

The aesthetic and recreational values of unique or outstanding waters should be recognized and protected by development of appropriate water quality standards for each individual case. To retain or establish unspoiled wilderness values, it may be necessary to control access by mechanized methods of transportation.

General criteria for recreation and aesthetic use and specific criteria for total body contact recreation follow:

A & R-1 General Criteria for Recreation and Aesthetics

Surface waters should be free of substances attributable to discharge of waste or land drainage which may impair aesthetic or recreational use, as follows:

(1) Materials that will settle to form objectionable deposits.

(2) Floating debris, oil, scum and other matter.

(3) Substances producing objectionable colour, odour, taste or turbidity.

(4) Materials, including radionuclides, in concentrations or combinations which are toxic or which produce undesirable physiological responses in humans, fish and other life and plants.

(5) Substances, including nutrients, and conditions, including temperature, or combinations thereof in a degree or concentration which produces undesirable types or abundance of aquatic life.

A & R-2 Criteria for Total Body Contact Recreation

Surface waters for total body contact recreational use should be free of substances attributable to discharge of waste or land drainage as follows:

(1) Materials which will cause the pH to change beyond the range 6.5-8.3.

(2) Materials which will obscure visibility in the water. In designated swimming and diving areas, clarity should be such that a Secchi Disc on the bottom is visible from the surface.

(3) Conditions which will cause the water temperature to exceed 85°F.

(4) Microbiological Criteria
Water used for body contact recreational activities should be free from pathogens including any bacteria, fungi or viruses that may produce enteric disorders or eye, ear, nose, throat and skin infections. Where ingestion is probable, recreational waters can be considered impaired when the coliform, fecal coliform, and/or enterococcus geometric mean density exceeds 1000, 100 and/or 20 per 100 ml respectively, in a series of at least ten samples per month, including samples collected during weekend periods.

If these criteria are exceeded, it will become necessary to determine the cause and initiate corrective action.

When evaluating a given area of water for recreational use, the appropriate numbers of samples, and the choice of tests to be performed should be determined by consultation between sampler and analyst, prior to sampling. An effort should be made to increase utilization of the fecal coliform and enterococcus tests since these presently appear to be the more relevant guides to the bacterial quality of bathing waters.

GLOSSARY OF TERMS

Bioassay — A controlled laboratory procedure which subjects live aquatic organisms to various environmental stresses.

Effluent Requirements — Numerical or verbal descriptions of the quality of a waste or drainage effluent at the point of discharge to a receiving water body, land disposal site or waste disposal well.

Eutrophication — The increase in the nutrient content of the natural waters of a lake or other body of water.

Geometric Mean — The nth root of the product of n observations. The equation for the geometric mean (G_x) can be expressed as:

$$G_x = \sqrt[n]{X_1 . X_2 . X_3 . \ldots\ldots\ldots\ldots X_n}$$

$$\text{or } G_x = \text{antilog}\left(\frac{\log X_1 + \log X_2 + \ldots . \log X_n}{n}\right)$$

Land Drainage — Water that has drained from the land surface naturally or through man-made drainage systems.

Milligrams per Litre (mg/l) — A unit of measure expressing the concentration of a substance in a solution.

Milligram equivalents per litre (mg. eq/l) — A unit indicating the chemical equivalence of ions; derived by dividing the concentration of an ion in milligrams per litre by the combining weight of that ion.

$$\text{Note: combining weight} = \frac{\text{atomic or molecular weight of ion}}{\text{ionic charge}}$$

Oligotrophic — Waters with a small supply of nutrients and hence a small organic production; usually having abundant dissolved oxygen at all depths.

Photosynthetic (adj.) — Relating to the process by which the chlorophyl-bearing cells of green plants convert carbon dioxide (CO_2) and water (H_2O) into sugar ($C_6H_{12}O_6$) and oxygen (O_2) in the presence of light.

Raw Water — Surface or ground water, prior to treatment.

Waste — Liquid carrying unwanted materials or compounds resulting from human activities or enterprises to a point of discharge. The mixture may or may not have received treatment.

Water Quality Criteria — Numerical or verbal descriptions of the quality of water required for particular uses.

Water Quality Standards — Numerical or verbal descriptions of the quality of water required for a variety of uses in a given drainage system.

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OAKVILLE

LEGEND

— SANITARY SEWER (EXISTING)

— SANITARY SEWER (UNDER CONSTRUCTION)

— STORM SEWER

— DRAINAGE DITCH

M-0.2 — STREAM SAMPLING POINT SHOWING MILEAGE

M-0.9 / D — OUTFALL SHOWING STREAM AND MILEAGE; TYPE OF OUTFALL

D — DRAINAGE DITCH

W — STORM SEWER

ONTARIO WATER RESOURCES COMMISSION

TOWN OF OAKVILLE
SOUTH - EAST AREA
WATER POLLUTION SURVEY
1971

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